

WHAT IS CLAIMED IS:

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1. A method for providing protective control to a tapped line in a power system, comprising the steps of:

measuring one or more local currents in a first protection element;

5 receiving, in the first protection element, one or more remote current measurements from a second protection element;

calculating one or more differential currents based on the local and remote current measurements;

10 receiving one or more local voltages and the one or more local currents in at least one distance protection element;

determining, in the at least one distance protection element, an apparent impedance from the one or more local currents and voltages.

2. The method of claim 1, wherein the first and second protection elements are protective relays.

15 3. The method of claim 2, wherein the first protection element includes the at least one distance protection element.

4. The method of claim 1, wherein the at least one distance protection element determines the apparent impedance for faults occurring along substantially the entire tapped line.

20 5. The method of claim 1, wherein the at least one distance protection element does not determine the apparent impedance for faults occurring in a busbar of a tapped transformer connected to the tapped line.

6. The method of claim 5, wherein the at least one distance protection element does not operate during an energization of the tapped transformer.

7. The method of claim 1, further comprising the steps of:

5 determining, for an external ground fault, one or more zero sequence currents; and

subtracting the one or more zero sequence currents from the one or more local currents prior to the step of calculating the one or more first differential currents.

8. The method of claim 7, further comprising the steps of:

generating a first restraining current based on the one or more first differential currents; and

outputting a first protective control signal based on the one or more first differential currents and the restraining current.

9. The method of claim 8, further comprising the steps of:

determining, for an internal ground fault, one or more second differential currents and one or more second restraining currents from the one or more local currents and the one or more remote currents;

outputting a second protective control signal based on the one or more second differential currents and the one or more second restraining currents; and

effecting a protective control operation based on both the first protective control signal and the second protective control signal.

10. A method for providing protective control to a tapped line in a power system, comprising the steps of:

measuring one or more local currents in a first protection element;

receiving, in the first protection element, one or more remote current measurements from a second protection element;

calculating one or more differential currents based on the local and remote current measurements;

calculating one or more restraining currents based on the one or more differential currents;

outputting a first protective control signal based on the differential currents and the restraining currents;

determining one or more zero sequence currents;

subtracting the zero sequence currents from the local and remote current measurements to generate modified current measurements;

calculating one or more modified differential currents from the modified current measurements;

calculating one or more modified restraining currents from the modified current measurements; and

outputting a second protective control signal based on the modified differential currents and the modified restraining currents.

11. The method of claim 10, further comprising the step of effecting protective control based on both the first and second protective control signals.

12. The method of claim 10, further comprising the steps of:
5 selecting a minimum of the differential currents and the modified differential currents;

selecting a corresponding restraining signal; and

effecting protective control based on the selected differential current and corresponding restraining signal.

13. The method of claim 10, wherein the first and second protection elements are protective relays.

14. The method of claim 10, further comprising the steps of:

receiving one or more local voltages and the one or more local currents in at least one distance protection element;

15 determining, in the at least one distance protection element, an apparent impedance from the one or more local currents and voltages;

generating a third protective control signal based on the apparent impedance; and

20 effecting protective control based on the first protective control signal, the second protective control signal, and the third protective control signal.

15. The method of claim 14, wherein the at least one distance protection element determines the apparent impedance for faults occurring along substantially the entire tapped line.

16. The method of claim 14, wherein the at least one distance protection element does not determine the apparent impedance for faults occurring in a busbar of a tapped transformer connected to the tapped line.

17. The method of claim 16, wherein the at least one distance protection element does not operate during an energization of the tapped transformer.

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